

fan

Construction and method ~~in~~ electric motor driveBACKGROUND OF THE INVENTION

1. Field of the invention ~~present~~ relates to an electric motor drive and a method. The object of this invention ~~is~~ the construction ~~in~~ ^{and more particularly} for of an electric motor drive, ~~where~~ an asynchronous motor, such as drum motor or similar motor, which has a stator mounted on a non-rotatory shaft and ^{a rotor which rotates} around the stator. Is a rotor, which is rotatory, like by means of bearings, connected on the same shaft and has a short-circuit arrangement, is arranged to drive a machine construction (actuator).

2. Description of the related art

- Above-described types of asynchronous, compact drum motors have been presented for example in publications EP 0 582 563, US 4,868,436 and FI 811414. Among these, ^{in these publications} the first-mentioned solution is carried into effect by keeping separate and individual copper short-circuit bars in ~~their~~ position by pressing them in place with collars mounted on the end flanges of ^a the motor.

- The disadvantage of this ^{arrangement} type of solution is the poor heat transmission from the short-circuit bars to the rotor shell. Further, in the solution of US-patent 4,868,436 ^{disclosed} the rotor structure is built up of ^a so called active part (i.e. electric plate package) and at least two separate rotor shell parts (i.e. support flange) and onto it by means of ^a screw coupling connected rotor shell, which makes the solution in question ^{arrangement} unnecessarily complicated. In application publication EP 0 617 155 there is a much similar solution (of above mentioned U.S.-patent), where ^a motor's rotor package, which is constructed/laminated of electric plates, ^{and} is

connected together with ~~its~~ short-circuiting
conductors to a drum roller by means of a screw/press
coupling, which operates as a roll surface. ~~Also~~ This
solution is disadvantageous especially in
5 manufacturing. ^{8/11/14} Further, in ~~latter~~ Finnish patent
application ^{8/11/14} is presented a drum motor, which is
designed especially for,

^{application}
elevator purposes. In this solution a separate roller
10 with cable grooves, and a brake surface area, for
elevator's lifting cables, and brakes ^{are} ~~is~~ mounted on the
upper shell of the rotor. ~~E.g. in this solution is~~
~~additionally proposed that~~ The motor cooling is ^{provided} ~~taken~~
~~care of~~ by machining radial ventilation holes in the
15 roller and stator and to blow ~~the~~ cooling air ^{into} ~~for~~ the
holes with a separate blower.

^{Relative to} ~~To all of~~ the above mentioned ^{approaches} ~~solutions~~ it is common ^s for the
that first of all respectively used machine,
20 construction ~~actuator's~~ connection to the drum motor ~~to~~
requires special mounting arrangements and/or extra
parts for it ~~is~~ a separate drive roll to be assembled
on to an electrical motor's rotor (EP 0 582 563), a
firmly assembled flange arrangement on the motor's
25 frame (US 4,868,436) or a shell to be assembled outside
the drum motor (FI 811414 and
EP 0 617 155 A1). ~~On the other hand in~~ The motor
constructions in the above mentioned innovations ~~the~~ ^{provide for}
cooling circulation ^{to be} ~~is~~ carried out by traditional
30 means. Thus, it is not possible to reach higher outputs
than with ~~a~~ standard drum motor ~~solutions~~.
What is needed in the art is an electric motor drive and a method of constructing
an electric motor drive which will provide a higher output.

SUMMARY OF THE INVENTION

The present invention provides an electric motor and a method for constructing an electric motor with a higher output.

The purpose of the construction of this invention is to overcome the above-described disadvantages and thereby essentially improve the level of the technique in this area. It is principally distinctive to the construction of the electric motor of according to this invention, to carry out this purpose, that the functional part of the machine/^{Motor's} construction, the ~~actuator~~, ^{such as a} like conveyor's driving-roll, or similar, is arranged to operate by having a short-circuit arrangement as the rotor of the asynchronous motor. In other words:

10 the "actuator" (e.g. driving roll) is formed ~~to~~ so as to constitute ~~itself~~ the rotor of the asynchronous motor, with the actuator ^{being} comprising the short-circuit arrangement.

15

^{one embodiment of}
The construction according to the invention is characterized by ~~that~~ the functional part of the machine construction, ^{the} ~~actuator~~, ^{such as a} like conveyor's driving roll, ^{being} ~~is~~ arranged to operate by having a short-circuit arrangement as the rotor of the asynchronous motor.

20

^{arrangement of the}
It should be noted that the ~~term~~ actuator ^{being} comprising the short-circuit arrangement is referring to many various ~~(or different)~~ embodiments. In the most simple embodiment, the actuator is formed as a one-piece solid roll shell being free from short-circuit bars and rings ~~and~~ ^{also} being free from laminated elements.

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In another embodiment (also being free from laminated elements) short-circuit bars and rings are provided. Each of the bars and the rings ^{are} ~~will be~~ located within the roll shell, preferably with a tight or positive fit

~~for locking~~ being provided between each bar and the roll shell, whereby additional mounting elements (e.g. collars and/or screws) are ~~not more~~ needed.

- 5 The most important advantages of the construction of this invention is the simplicity of its construction, manufacturing and usage, ^{its} efficiency and reliability of working, ^{and} which ~~attain~~ the most possible integrated and compact machine configuration ^{possible} ~~which allow to get~~ ⁱⁿ this configuration allow
- 10 higher output and higher torque from the ~~used~~ asynchronous massive rotor and ^a significantly ~~to~~ improvement in its performance in other ways ^{as well} ~~too~~. The simplicity of the construction of this invention ~~as advantageous~~ ~~solution~~ is based ~~on~~ ^{the} fact ^{that} there is no need to use
- 15 traditional short-circuiting conductors, ~~as~~ ^{since} the short-circuit arrangement is established directly ~~into~~ ^{on the} the functional part of the machine construction ~~actuator~~, ^{as the} such as ~~a~~ like conveyor's driving roll. On the other hand the structure of
- 20 this invention makes it possible to use ~~the~~ traditional short-circuiting connectors in a new way, so that they are located ~~essentially~~ internally ^{to} ~~on~~ a functional part of the machine construction (actuator) as the rotor shell, ~~like~~ ^{such as} conveyor's driving roll. ~~When applying~~
- 25 ~~advantageously~~ the structure of this invention, the asynchronous motor is equipped with primary and secondary cooling circulation to cool both the stator and the rotor ~~for example so that the~~ ^{the} cooling fluid is ~~firstly essentially~~ carried through the stator shaft
- 30 and with the help of ~~the~~ holes in the shaft ~~elsewhere~~ as ^a parallel flow through the flow system in the rotor shell. ~~As a further improvement, the rotor is manufactured of~~ ^{an} electric ^{high} conductive compound metal

structure, where copper short-circuit bars or pipes and rings are ~~for example~~ explosion welded into pre-drilled/machined holes/slots. On the other hand during manufacturing ~~of~~ of the asynchronous motor it is ^{also} possible to utilize ~~also~~ a casting technique.

A further embodiment of the present invention,
Further advantageous solution is to assemble the stator on the hollow shaft/pipe ^{which also serves as} ~~also working as~~ stator shaft, that which is used ~~for example~~ to feed over-pressure cooling air. Here ^{this} ~~with it~~ is effectuated ^{by using} a hermetic primary cooling ^{medium}, which is known from EP 0 617 155 and which prevents dirt ^{from} ~~to~~ penetrate into the drum motor, which is not possible ~~to prevent~~ with the conventional, ~~effectuated freely (open)~~ breathing air-cooled solutions. *A further embodiment of the present invention, provides*
15 ~~Further advantageous feature is that the~~ ^{to be} for short-circuit hollow bars or pipes ~~are~~ positioned within the rotor shell, functioning as secondary cooling channels. Thereby ^{making it} ~~it is~~ possible to carry ~~the~~ cooling air to the hottest spots of the rotor, which
20 helps ~~in its way significantly~~ both to obtain the maximum output and to increase the amount of starts/stops ~~of the machine construction~~ (actuator) equipped with the motor ~~in question is capable of,~~

25

The advantageous solutions of the structure of the invention have been presented in separate independent patent claims.

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Object of this invention is also a method for equivalent purpose, which is more specifically described in independent patent claim's introduction

section and whose characteristic features in corresponding patent claim's characteristic section.

^{another embodiment of}
The method according to the ^{present} invention is characterized
5 by ~~that~~ the functional part of ~~the~~ ^{present} machine construction, an
~~actuator~~, ^{such as a} like conveyor's driving roll, ^{being} arranged
to operate by having ^a short-circuit arrangement as the
rotor of the asynchronous motor.

10 One of the most ^{of} important advantages ^{are} the method of this
invention ~~has~~ ^{is} the simplicity of the operating
principle, ~~and~~ the simple constructions which makes it
possible, ~~and~~ the reliability of ^{the device} working ~~and which~~
15 allows to gain the utmost compact machine construction
(actuator) ~~with~~ ^{which} integrally ^{tes} ~~united~~ ^{an} asynchronous
motor to achieve high mechanical load capacity,
vibration strength, and high starting and operation
torque features. The simplicity of the method of this
20 invention ~~as a advantageous solution~~ is based ~~for~~
~~example~~ on the fact that there is no need to use a
separate laminated rotor component with traditional
short-circuiting conductors inside a functional part of
the machine construction, ~~by establishing~~ ^{rather} a short-
25 circuit arrangement ^{is integrated} directly into the functional part
of the machine construction (actuator), ~~like~~ ^{such as a} conveyor's
driving roll. On the other hand ^{it} the method of this
invention makes it possible to ~~use the~~ ^{utilize} traditional
short-circuiting connectors, ~~in a new way, so that they~~
30 ~~are~~ located essentially internally on a functional part
of the machine ^{of}
construction (actuator) as the rotor shell, ~~like~~ ^{such as a}
conveyor's driving roll.

~~Furthermore as~~ An advantageous development of this innovation, ^{make} it is possible to increase an air gap diameter between ^{the} stator and ^{the} rotor once a maximum outer diameter and total length of a drum motor is limited. Thus by this innovative design it is possible to get higher output power and higher torque ^{as} compared to an asynchronous drum motor having ^{the} same main dimensions as this new innovative drum motor construction and having a standard laminated rotor component inside a rotor shell.

~~A Furthermore as~~ an advantageous development of this method is ~~to~~ ^{the} minimizing ^{action of} the manufacturing costs of the ~~here-mentioned~~ massive motor ~~for example by~~ manufacturing the rotor and the associated slots ~~by~~ from casting ~~them of~~ steel.

~~A further advantage of this~~ ^{is that} Applying the method advantageously ~~the~~ asynchronous motor is ~~being~~ cooled effectively ^{allowing a} to get higher output than with conventional ^{motors} ~~ones~~ ^{can be reached, because} correctly carried out ~~i.e. according to~~ ^{provides an} ~~this invention~~ realized ^{seal} for example hermetic and essentially in axially directed direction ~~(through the asynchronous motor)~~ ^{or} cooling fluid flow ^{which} makes ~~it~~ possible ~~for example to direct the directing of~~ over-press cooling air to the hottest spots of the rotor, which ^{in turn allows} is ~~an~~ essential condition both to increase in the maximum output and ^{can} ~~to~~ increase ^{number} the amount of starts/stops. On the other hand compared to the ~~freely~~ breathing air-cooled ^{motors, the present invention} ~~solutions~~ ^{prevents} this solution especially in hard conditions ~~filth~~ ^{from} penetrating into the drum motor structure.

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Cooling of ^{an} asynchronous motor with a solid rotor can be realised either with or without a secondary cooling arrangement ~~via~~ ^{of} hollow bars or tubes inside a functional part of the machine construction (actuator) such as the rotor shell. In ~~such constructions~~ ^{the cooling is taken care of only with a primary cooling arrangement ~~for~~ ^{with a secondary cooling arrangement} ~~to give~~ ^{to give} air flow} though an air gap between ^{such as an} inner surface of a rotor shell and an outer surface of a stator component.

- Furthermore, it is important that the short-circuit bars and rings ~~belonging advantageously to the short-circuiting adjustment~~ are arranged essentially integral with rotor shell, ~~at least partly or even totally,~~ ^{at least partly or even totally,} with internal arrangements ^{such an arrangement provides for} and thus also ^{transfers} a much more efficient heat ~~conduction than present~~ between the steel shell and the copper short-circuit bars and rings ^{than} can ~~be accomplished~~ ^{be} ~~than with the~~ traditional solutions.
- 20 This also ~~gives better possibilities~~ ^{allows} for higher output and ~~to increase~~ ^{as} the ~~starts and stops of the~~ ^{in number of} asynchronous motor within a ~~certain~~ time interval.

- 25 Advantageous solutions of the method of the invention have been presented in separate independent patent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

- The invention is in more detail presented in the description and the attached drawings.

Figure 1 presents

a longitudinal cross section of a typical machine construction (actuator) unit, which is accomplished with the method in this invention and

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Figure 2 presents ^{sectional} a cross profile of ^{a section along line} spots Fig 2 - Fig. 2" in Figure 1.

10 Figures 3a - 3C present

some alternative massive motor constructions of a drum motor.

Figures 4 and 5 present

15

a drum motor designed according to ^{one embodiment of} the present invention and integrated to one end of a vacuum belt conveyor construction, with Fig. 5 being a section along line V - V of Fig. 4.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figures 1 to 3, ^{now to the drawings & more particularly} the object of this ~~invention~~ ^{is} shown the

~~invention is a construction of an electric motor drive, the electric motor drive~~ ^{being} a so called solid asynchronous motor, which has

stator 2 mounted on a non-rotatory shaft 1 and around the stator ^{is} a rotor 4, which is, ~~like~~ by means of

25 bearings 3, rotarily connected on ~~the same~~ shaft 1 and having

~~has~~ a short-circuit arrangement ~~is~~ designed to drive a machine construction (actuator). The functional part of the machine construction (actuator), ^{such as} ~~like~~ conveyor's 5 (fig. 4) driving roll 5a, ~~or~~ 5b or 5c, is designed to operate by an

30 integrally connected short-circuit arrangement ~~as the~~ of rotor 4 of the asynchronous motor. Especially in Figure 3c ~~is shown~~ ^{is} the most simple ^{embodiment} structure of the invention, in which conveyor's driving roll 5a is realized with a

Driving roll 5a

solid shell, ~~which~~ operates directly as the short-circuit arrangement of ~~the~~ rotor 4 without any traditional laminated rotor component ^{having} with short-circuit conductors (e.g. short-circuit bars and rings).
 5 ~~An alternative embodiment of the solution according to~~ this principle is ~~also~~ shown in Figure 3b, where driving roll 5b is designed to operate as the rotor of the asynchronous motor with the solid shell having on its inner surface drilled or machined holes or grooves ^{5d}.

10

Different from Figures 3b and 3c, the invention may be advantageously used in connection with the structure, where the short-circuit arrangement ~~can be~~ realized in ~~the~~ rotor's shell 4a with short-circuiting conductor bars 4b and rings ^{2, 4b and 18 are part of the present invention} 18. In this ~~connection short-circuiting connector bars 4b and rings 18 are arranged~~ to operate at least partly internally of .

15

~~the~~ rotor's shell 4a operating as ^a functional part of
 20 the machine construction (actuator), such as conveyor's driving roll 5c. ~~This type of solutions are presented~~ *Examples of this*
~~embodiment are shown in~~ ^{especially in} Figure 2, where round short-circuit bars 4b are being used and in Figure 3a where quadrangular short-circuit bars 4b' are being used in rotor shell
 25 4a'. ~~The Bars 4b~~ ^{as} shown in Figure 2 may be hollow, so that each bar ~~comprises~~ ^{includes} a channel 4c for piping cooling fluid. At each end of shell 4a, a flange 7 is provided which connects the shell to one of the bearings 3.

25

Referring now to yet another embodiment of the invention
 30 ~~Figure 3a~~ ^{is} shown ~~a design~~, where conveyor's driving roll 5a is realised by a solid shell having quadrangular short-circuit bars on its inner surface. This type of electrical motor design should be used

when a compact drum motor constructions (e.g. maximum outer diameter and total length of the drum motor are limited) with high output power and torque are desired. Such a compact drum motor is needed in vacuum belt conveyors used for "tail threading" in paper machines.

A typical design of drum motor's stator component 2 consists typically a pile of 0.3 - 1.0 mm thick electrical sheets 21 which are mounted on ~~the~~ stationary hollow shaft 1 and fixed at their position by spot welding stator end plates 20 to ~~the~~ stationary ^{hollow} shaft 1. Stator windings 6 are connected via electrical connection cable 19 to an external electric grid.

Referring now to

here is

15 ~~A Figures 4 and 5~~ show one end of a vacuum belt conveyor including ~~comprising~~ an endless air pervious belt 10 which ~~is in operation~~ travels across two rotary pulleys, only one pulley 4 being shown. The pulleys are supported by ~~a~~ vacuum box 11. Therein a negative pressure ~~will be~~ ^{is} created by ~~a~~ vacuum source (not shown). The negative pressure ~~will~~ propagate through openings 12 of ~~a~~ cover plate 13 and through belt 10 in

order to convey a web of paper or similar material, in particular a lead strip or "tail" which has been separated from threading purposes (see e.g. US patent 3,355,349).

In order to drive ~~the~~ belt 10, ~~a~~ pulley 4 is designed as the rotor of an electric motor drive according to the present invention. Similar to Figure 1, ~~a~~ stationary hollow shaft 1 supports ~~a~~ stator 2 and (by means of bearings 3) ~~the~~ rotor 4, - which is ~~the~~ pulley 4

of the vacuum belt conveyor ~~M~~ and which ~~again~~
comprises ~~H~~ rotor shell 4a and two end-flanges 7.

- Preferably, the following measures may be provided in
5 order to adapt the electric motor drive to the demands
of a vacuum belt conveyor:

- ~~the~~ Width W of conveyor 5 (and also ~~the~~ length L) of the
pulley's shell 4a should be relatively small, about
10 0.25 m. The pulley's ~~4a~~ diameter should preferably be
less than 0.15 m. ~~On the other hand, the speed of the~~
belt ~~should~~ be about the same as the operating speed of
modern paper machines which may exceed 2000 m/min.
Therefore, there is a need for very high motor output
15 while the dimensions of the motor drive should be
relatively small.

- To fulfil these demands, ~~the~~ distance D between the
bearings 3 is larger than ~~the~~ length L of ~~the~~ pulley's
20 shell 4a, in order to increase the internal space being
available for stator 2 and for the short-circuit
arrangement of ~~the~~ rotor 4. As a consequence, each
flange 7 is formed as a bushing which bridges the
difference between length L and distance D .
25 Furthermore, each of ~~the~~ supporting brackets 8 which
connect ~~the~~ stationary shaft 1 to the side walls of ~~the~~
vacuum box 11 is formed similar to a 'Z' (in other words:
it is "double
30 folded"). In addition, each support bracket 8 may be
wrapped around the periphery of one of ~~the~~ flanges 7.

In order to improve the cooling effect, ~~the~~ hollow shaft 1 comprises at one of its ends an internal (e.g. coaxial) supply channel (15) as well as a discharge channel 16, as a result, ~~all the~~ cooling fluid X must pass the inner side of stator 2 as well as its outer side and the inner side of ~~the~~ rotor⁴ (plus the channels 4c, if existing, in ~~the~~ bars 4b/in Figure 1).
as shown

~~Also, the following is advantageous.~~ The above mentioned supporting brackets 8 can be used (also) as a connection surface for vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers) (which ~~is~~ ^{are} not shown as ~~practical solution~~ in the ~~enclosed~~ drawings).

15 In addition to the ~~things mentioned above~~ ^{foregoing}, the cooling of the machine construction (actuator) operating as ~~a~~ rotor⁴ of a asynchronous motor is realized ~~advantageously~~ mainly with primary cooling by carrying over-press cooling air X in ^{an} axial direction through ~~the~~ stator shaft 1, which can be for example a hollow shaft, pipe or similar ^{device} ~~and it~~ ^{stator shaft 1} is equipped with ~~its~~ a first flow arrangement 1a. ~~On the other hand when using advantageously the structure of this invention~~ It is possible to boost the cooling of the asynchronous motor ~~beyond~~ besides what was ^{is} described ^{above} ~~or~~ ^{rather} or instead of it by way of ~~also with secondary cooling~~ ^{which employs} by equipping the short-circuiting bars 4b' with ~~another~~ flow arrangement 4c. Then, ~~for example~~ ^{an} it is possible to carry cooling air X in ^{an} axial direction through ~~the~~ hollow copper short-circuit bars 4b, ~~for example~~ according to the principle in Figure 1 with the help of ~~the~~ holes 1b in ~~the~~ stator shaft 1 together with ~~the~~ primary air flow

- 1a which take place together with the parallel flow to the hottest sports of the rotor, which ^{enables a} helps to get higher output from the machine construction (actuator) and especially to ^{allow more} ~~improve to carry~~ the short run starts/stops.

- Once an asynchronous motor has a solid rotor's cross section as shown in Figures 3a, 3b and 3c, cooling is taken care of ^{by} an air flow arrangement through an air gap ~~which~~ ^{is} located between an inner surface of a rotor shell 5a, 5b, 5c and an outer surface of stator component 2.

- ~~Yet another embodiment of the present invention~~
Further advantageous solution of the structure of the invention is to manufacture the rotor of electrically conductive compound metal structure, where copper short-circuit bars 4b; 4b' are integrally connected to ~~the~~ steel rotor shell 4a; 4a' for example by explosion welding or by centrifugal casting.

- 20 It is possible with the asynchronous motor, realized according to the invention, when using ~~especially~~ star type coupling for windings, to get the output of the drum motor equipped with three, four, or six pole stator windings ^{which} ~~always~~ reach the (level) 0.5 - 500 kW and to have the speed of rotation typically in the area of 0 - 20000 rpm.

- ~~yet still a further embodiment of the present invention~~
~~As a further advantageous development~~ (which is not shown in ~~the~~ ^{the} enclosed drawings) ~~it is advantageous to~~ ^{there may be provided} benefit the ^{for} frequency transformer ~~used~~ by the asynchronous motor, which is equipped with active rotation speed control. In this ~~connection~~ ^{embodiment} rather

traditional solutions can be used to achieve the ~~wanted~~ ^{desired} effect.

And, is yet another embodiment of the present invention

- The ~~object of this invention~~ is ~~also~~ a method with an electric motor drive, where the machine construction (actuator) is used ~~by~~ ^{as} an asynchronous motor, such as a drum motor, which has ~~stator~~ ^{stator} 1 and ~~around the~~ ^{around} stator ² is ~~rotor~~ ^{rotor} 4, which is ~~rotating~~ ^{rotating} ^{like} by means of bearings 3, connected on ~~the same~~ ^{the same} shaft 1 and ~~has~~ ^{with} a short-circuit arrangement. The functional part of the machine construction (actuator), ~~such as~~ ^{such as} conveyor's 5 driving roll 5a, is arranged to operate by having ^a short-circuit arrangement as ~~the~~ rotor 4 of the asynchronous motor (typical constructions shown in Figures 2 and 3a). The method according to this principle is applied in the simplest way ~~for example~~ ^{as shown} in constructions ~~in Figure~~ 3b, wherein driving roll's 5b machined grooves/slots 5d are arranged as the short-circuit arrangement. On the other hand in Figure 3c is a similar type of solution without traditional short-circuit bars, wherein ~~the~~ driving roll 5a is realized ^{as} a solid shell, which operates directly as the short-circuiting arrangement.

As a further embodiment

- Furthermore ~~as an advantageous application~~ of this method it is advantageous to benefit ~~the~~ ^{the machine construction} with an asynchronous motor, whose short-circuit arrangement is connected to ~~the~~ rotor 4, ~~the~~ ^{such as} short circuiting bars 4b and rings 8 ^{which} are supported on rotor's shell 4a. In this connection short-circuit bars ^{4b} and rings ⁸ belonging to the short-circuit arrangement are arranged to operate at least partly internally ~~as~~ ^{to} ~~the~~ ^{of} rotor's 4/shell 4a of the operating functional part of the machine.

construction (actuator), such as conveyor's driving roll 5a. In this ~~connection~~ ^{arrangement} this type of solution is ~~as~~ presented, ~~especially~~ in Figure 2, showing round short-circuit conductors 4b and further in Figure 3a showing quadrangular short-circuit bars 4b'.

Furthermore referring to Figure 1 this method can be used with an asynchronous motor which is arranged to be cooled ~~by having~~ ^{with} a fluid flow. The cooling of the asynchronous motor is realized as a closed system by carrying ^a cooling fluid, such as over-press cooling air X, hermetically ~~essentially~~ ^{as} in ~~axial~~ ^{axial} direction in ~~a~~ primary flow arrangement 1a through ~~the~~ stator shaft 1 ^{such as a} ~~like~~ hollow shaft, pipe or similar ^{device}. ~~On~~ ^{the other hand} the cooling of the asynchronous motor can be arranged ~~instead of as~~ ^{in a manner other than that} described above by carrying ^a cooling fluid, such as over-press cooling air X hermetically ~~essentially~~ ^{as} in ~~axial~~ ^{axial} direction in a secondary flow arrangement 4c provided in short-circuit conductors 4b, ^{such as} ~~like~~ hollow bars or pipes.

~~Especially~~ Referring to Figure 1, as an example. Rotor 4 of the solid asynchronous motor is manufactured of an electric ^{ally} conductive compound metal structure, ~~when with~~ ^{advantageously}, for example, copper short circuit bars 4b which are welded, ^{such as} ~~like~~ explosive welded or butt welded, into the holes in ~~the~~ steel rotor shell 4a or that they are cast integral with a most suitable ^{such as a} using a casting method, ~~like~~ ^{such as a} press casting method. ~~(solution is not presented in Figure 1).~~ ^{the} ~~When~~ ^{in the assembly wherein} above mentioned methods every short-circuit bar 4b and ring 18 is integrated as an integral part of rotor shell 4a, ~~which~~ ^{this arrangement} allows to achieve better heat transmission between the

steel shell and copper short-circuit conductors. This fact ~~has~~^{is of} great importance when trying to get higher maximum power from the machine constructions (actuators) than with traditional solutions and especially when short run starts/stops are ~~in question~~^{numerous}. The same is true with the embodiment shown in Figure 3a comprising rotor shell 4a' and bar 4b'.

It is obvious that this invention is not limited to the above mentioned or explained solutions, it can be considerably modified within it's basic idea. Thereby it is possible ~~finally~~ to utilize the construction or arrangement of this invention in ~~most~~ different ~~various~~ connections, whereupon the dimensions and constructions can considerably differ from the hereby presented example drawings. ~~On the other hand~~^{Further} other type of fluids can be used in the cooling of the asynchronous motor realized according to the invention or the cooling can be done differently from what ~~is~~^{is} presented above.

Claims are in
VOI 0200.CIMS

Claims

1-3 1. A construction in electric motor drive,
5 where an asynchronous motor, such as drum motor,
which has a stator (2) mounted on a non-rotatory
shaft (1), and around the stator is a rotor (4),
which is rotatory, like by means of bearings (3),
connected on the same shaft (1) and has a short-
10 circuit arrangement, is designed to drive a machine
construction (actuator), characterized in that the
functional part of the machine construction
(actuator), like conveyor's (5) driving roll (5a,
5b, 5c), is arranged to operate by having short-
15 circuit arrangement as the rotor (4) of the
asynchronous motor.

4 2. The structure as claimed in claim 1,
wherein the short-circuit arrangement is established
20 by the short circuiting bars (4b, 4b') and rings
(18) supported on the rotor's shell (4a, 4a'),
characterized in that the short-circuiting bars (4b,
4b') and rings (18) belonging to the short-circuit
arrangement are arranged integral with the rotor's
25 (4) shell (4a, 4a'), which is a functional part of
the machine construction (actuator), like conveyor's
driving roll (5).

5,6 3. The structure as claimed in claim 1 or
30 claim 2, wherein an asynchronous motor is arranged
to be cooled by having a fluid flow, characterized
in that the cooling of the asynchronous motor is
realized in a closed system, by carrying cooling

fluid, such as over-pressure cooling air (x) hermetically essentially in axial direction with its primary flow arrangement (1a) through the stator shaft (1) like hollow shaft or pipe and/or with secondary flow arrangement (4c) through short-circuit conductors (4b) like hollow bars or pipes.

4. The structure as claimed in any of the claims 1-3, characterized in that the rotor (4) of the solid asynchronous motor comprises an electric conductive compound metal manufactured structure, preferably comprising copper short circuit conductors (4b, 4b'), which are welded by explosive welding, butt welding into the holes in the steel rotor shell (4a, 4a') or that they are cast integral with the rotor shell in their places by a suitable casting method (e.g. centrifugal casting method).

5. The structure as claimed in any of the claims 1-4, characterized in that that when using especially star type coupling for windings, the output of the asynchronous motor equipped with three, four, or six pole stator windings is 0,5 - 500 kW having speed of rotation 0-20 000 rpm.

6. The structure as claimed in some of the claims 1-5, characterized in that the asynchronous motor is having a frequency transformer drive, which is equipped with an active rotation speed control.

7. The structure as claimed in some of the claims 1-6, characterized in that the rotor is

10 formed as a shell of a pulley (4) which is part of a vacuum belt conveyor (5) comprising a stationary vacuum box (11), the rotor drive further comprising:
5 said central shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box (11).

11, 10 8. The structure as claimed in some of the claims 1-7, characterized in that the drum motor's supporting brackets (8) can be used also as a connection surface(s) of the vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers).

12 15 9. The structure as claimed in claim 7, characterized in that the distance D between the bearings (3) supporting the pulley (4) is larger than the length L of the pulley's shell (4a).

13 20 10. The structure as claimed in claim 9, wherein each flange (7) which connects an end of shell (4a, 4a') to one of the bearings (3) is formed as a bushing which bridges the distance between length L and D.

14 25 11. The structure as claimed in claim 9, wherein each supporting bracket (8) - seen in a longitudinal section of the conveyor (5), in Figure 5 - is formed double-folded similar to a Z.

30 12. Method for electric motor drive, where a machine construction (actuator) used by an asynchronous motor, such as drum motor, which has a

15 stator (2) mounted on a non-rotatory shaft (1) and
around the stator is a rotor (4), which is rotatory,
like by means of bearings (3), connected on the same
shaft (1) and has a short-circuit arrangement,
5 characterized in that the functional part of the
machine construction (actuator), like conveyor's (5)
driving roll (5a), operates by having short-circuit
arrangement as the rotor (4) of the asynchronous
motor.

10 13. Method as claimed in claim 12 with
asynchronous motor, where the short-circuit
arrangement is realized in connection with the
rotor (4) like having short-circuit conductor bars
15 (4b, 4b') and rings (18) supported on the rotor's
shell (4a), characterized in that to the short-
circuit arrangement operate at least partly
internally as the rotor's (4) shell (4a, 4a') of the
operating functional part of the machine
20 construction (actuator), such as conveyor's driving
roll (5a, 5b, 5c).

25 14. Method as claimed in claim 12 or 13
wherein a asynchronous motor is cooled by having a
fluid flow, characterized in that the cooling of the
asynchronous motor is realized as closed by carrying
cooling fluid, such as over-press cooling air (x)
hermetically essentially in axial direction with
30 it's primary flow arrangement (1a) through the
stator shaft (1) like hollow shaft or pipe and/or
through with secondary flow arrangement (4c)
equipped short-circuit conductors (4b') like hollow
bars or pipes.

15. Method as claimed in some of the claims 12-14, characterized in that the rotor (4) of the solid asynchronous motor is manufacture of electric conductive compound metal structure, when upon most suitable are copper short circuit conductors (4b, 4b'), which are connected into the holes and/or grooves by welding, like explosive welding or butt welding in the steel rotor shell (4a, 4a') or that they are cast integral within the rotor by a suitable casting method, like centrifugal casting method.

16. Method as claimed in some of the claims 12-15, characterized in that the rotor is formed as a shell of a pulley (4) which is part of a vacuum belt conveyor (5) comprising a stationary vacuum box (11), the rotor drive further comprising: said central shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box (11).